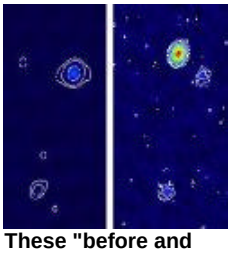
SCIENCE NEWS
GALAXIES

Nearby Supernova Factory Models Early Universe

An exploding star suspended in thick gas and dust may help shed light on the first galaxies.

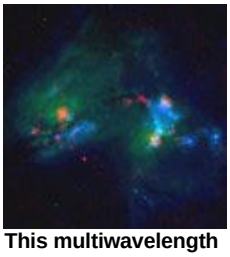
by Maggie McKee



These "before and after" radio images of a dense region in Arp 299 reveal a new supernova. ***Ulvestad, Neff, Teng / NRAO / AUI / NSF***

Supernovae were once a precious commodity — just five were recorded in the history of humanity until the first telescopes were built. Now, while scientists still thrill at what these exploding stars can reveal about the universe (dark energy's dominance, for instance), individual finds are often taken for granted. But one particular supernova in a pair of colliding galaxies called Arp 299 took center stage Tuesday at a meeting of the American Astronomical Society in Nashville, Tennessee.

That's because the supernova, found this past February, lies in a "super star cluster" that may host a million stars, each as massive as 20 suns, within a dense region of gas and dust. At 140 million light-years away, the cluster in one of the galaxies of Arp 299 is the closest of just 10 or so nearby super star clusters. But billions of light-years from Earth, these dense stellar nurseries are ubiquitous. At those distances, the universe looks as it did soon after the Big Bang, when galaxy mergers were more common and the cosmos was smaller and denser.



This multiwavelength image of the colliding-galaxy pair Arp 299 was made using data from the Very Large Array and Hubble Space Telescope. ***NRAO / AUI / NSF / STScI / NASA***

Finding nearby super star clusters are a boon to astronomers who want to learn more about those in the distant universe. "We look for close mergers and we can infer what's going on in more distant objects," said James Ulvestad, an astronomer at the National Radio Astronomy Observatory, which operates the Very Long Baseline Array, a linked group of 10 radio telescopes that made the observation.

The two galaxies in Arp 299 share a tumultuous history. Almost a billion years ago they "passed by each other and messed each other up," said Susan Neff, a scientist at NASA's Goddard Space Flight Center and another of the researchers who found the supernova. Then, the galaxies had a second close encounter 6 million to 8 million years ago that compressed the gas and dust between them, creating super star clusters that gave birth to a new generation of massive stars. Now, scientists believe, those baby boomer stars should be reaching the end of their lives, detonating themselves in supernovae at an estimated rate of one every two years. (Normal galaxies host about one supernova per century.)

In fact, last year researchers spotted four suspected

Super star clusters formed ubiquitous starburst galaxies in the early universe. ***Adolf Schaller for STScI***

supernova remnants in an area 350 light-years across, one only 7 light-years from the newly found supernova. And since 1990, four other supernovae have been observed optically in less dense regions of Arp 299. Another observation persuaded researchers that they had indeed found a so-called supernova factory. In super star clusters like these, thick gas and dust are thought to hem in the material blown off the dying stars, and this region, called Source A, fits that profile.

"I think the most exciting thing is seeing individual stars blow up because ... you can learn details ... like how massive they are," said Daniel Weedman, an astronomer at Cornell University who likens the new result to being onstage at a nighttime concert. "You theorize thousands of people are out there, but if you see a flashbulb go off, that teaches us about people: some have cameras."

The discovery is as much a triumph for technology as it is for early universe studies. The dust and gas in which these stars and supernovae are embedded is so thick that only x rays and radio waves can penetrate it. But only the VLBA, whose linked telescopes have the resolution of a single dish spanning the distance from Hawaii to the U.S. Virgin Islands, can resolve the supernova and neighboring remnants.

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